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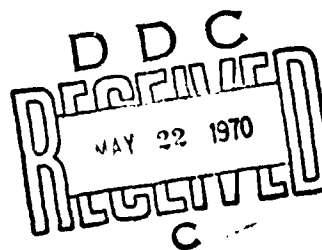
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Progress Report on Work Unit UTILITY

by

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Prefatory Note

This paper, based on a briefing presented by the senior author, concerns early findings of research done by the Human Resources Research Organization, Division No. 3, at the Presidio of Monterey, California, under Work Unit UTILITY, Study of Soldiers in Lower Mental Categories: Job Performance, and the Identification of Potentially Successful and Potentially Unsuccessful Men.

The briefing was presented four times in September and October, 1969: (1) to a group of key officials from the Office of the Deputy Chief of Staff for Personnel, Department of the Army; (2) to the Assistant Secretary of the Army for Manpower and Reserve Affairs, and to Army Research and Development officials; (3) to the Commanding General and Deputy Commanding General of the U.S. Continental Army Command; and (4) to the Assistant Secretary of Defense for Manpower and Reserve Affairs, and members of the Department of Defense Manpower Management Planning Board.

PROGRESS REPORT ON WORK UNIT UTILITY

Robert Vineberg, Elaine Taylor, and John S. Caylor

This is an initial report of some of the more immediate findings from the research under HumRRO Work Unit UTILITY, part of the long range research associated with Project 100,000. Since the kinds and amount of information gathered in this Work Unit are considerable, it will be some time before results of the entire analysis can be provided.

The primary objective of Work Unit UTILITY is to find out how soldiers in Mental Category IV (CAT IVs) and in other mental categories¹ compare in the performance of selected Army jobs.

Next, our intent is to map areas within jobs where greater and lesser degrees of competence are displayed. Such a mapping should produce more specific information about variations in capabilities or skills and thus provide a basis for estimating how other jobs, not included in the study, are likely to be performed by men in these different groups.

The final objective is to identify different factors that may be associated with satisfactory performance at different Armed Forces Qualification Test (AFQT) levels. Specifically, we want to explore both the role of a man's background and personal characteristics and his more general Army experiences, such as the type of training he has received and the length of time he has spent in the job, as they relate to the way in which he performs.

This research will provide a variety of information. We are gathering data about a man, his experiences, and his performance. Information about a man ranges from his AFQT score to biographical data such as the kind of work he did before entering the Army. In considering his experiences, we are gathering data about his training, his amount of job experience, and the kinds of things he typically does in his job. Thus, we expect to be able to catalogue and compare the general duties of CAT IVs and Non-CAT IVs who are in the jobs selected for testing. We are measuring performance with job sample tests, job knowledge tests, and supervisor ratings. Using three measures of performance, in addition to providing different kinds of information, will also enable us to study the relations among the measures themselves.

¹	Mental Group	Percentile Score
	I	93--100
	II	65--92
	III	31--64
	IV	10--30

It is hoped that this information will be useful in screening, preparing, and assigning men of lower ability. The material should also be appropriate in considering the utilization of men at other AFQT levels, it is not unreasonable to foresee different kinds of treatment suggested for men at different aptitude levels. Thus, selective assignment, additional training, or the total restructuring of jobs may be choices for men at the lower end of the spectrum, whereas, for men at the upper end, options such as shortening or eliminating formal training might be suggested.

Currently, of course, a considerable and diverse body of information is being amassed by the military about the performance of men all along the AFQT range. Particular attention is being given to those of lower mental ability in Project 100,000. Some of this information, embodied in statistics on ANOL rates and other offenses, deals with questions of general military suitability. Most available information, however, is descriptive of performance in training situations—for example, success in Basic Combat Training and Advanced Individual Training. Information about how jobs are actually being performed is less accessible, and where it exists, most often practical necessity dictates that it be derived from supervisor ratings rather than from the direct measurement of job behavior. Perhaps the single most important feature of Work Unit UTILITY lies in the use of intensive job sample tests as the primary vehicle for the description and assessment of job performance.

In gathering UTILITY data we did not deal solely with subjects who came into the service as part of Project 100,000. Had we considered only these men, our sample would have been restricted in two ways—the total number of subjects available would not have been sufficient, and we would have been limited to studying men with no more than two years of job experience.

One of the first steps in this research was to select the jobs or MOSs where performance was to be examined. Based on a random sample of approximately 5,000 CAT IVs and 5,000 Non-CAT IVs, received from the U.S. Army Data Support Command in March 1967, we estimated the proportion of men in Category IV who were in different Army jobs at that time. As a result of this information, and consultation with persons in the Office of Assistant Secretary of Defense (Manpower), we selected the MOSs shown in Table 1.

We have not made a formal attempt to keep abreast of changes in the ratio of CAT IVs to Non-CAT IVs in these jobs during the progress of this research. However, our experience suggests that the proportion of CAT IVs has risen consistently since we received the original figures. Thus, in April 1969, we found that in the 4th Armored Division 39% of the Armor Crewmen and 32% of the Supplymen were CAT IVs.

We believe that these MOSs give a reasonably good representation of different kinds of jobs. Most are highly populated; with the exception of the Armor Crewman, they represent jobs that have counterparts in both of the other services and in civil life. The Armor Crewman is a combat job where many of the tasks, dictated by hardware requirements, are highly procedural. The General Vehicle Repairman represents a

Table 1
Percent of Category IV Men
in Selected MOSs

<u>MOS</u>	<u>PERCENT</u>
11E ARMOR CREWMAN	25
63C GENERAL VEHICLE REPAIRMAN	13
76Y UNIT AND ORGANIZATIONAL SUPPLY SPECIALIST	25
94B COOK	26
91A MEDICAL CORPSMAN	22

maintenance job involving diagnostic and interpretive skills. The Supplyman's job is largely a clerical one, requiring the coordination of information. The Cook, a job where men of lower aptitude have frequently been placed, involves largely procedural tasks in which a man must meet rather precise standards while following specified instructions. In the Medical Corpsman's job, providing patients with personal service while attending to their medical needs is paramount. Incidentally, data collection for the "medics" has only recently been completed and the results in that MOS are not yet available.

The overall plan was to select pairs of men for testing, each pair including one man in Category IV and one in Categories I-III. Pair members were matched for amount of time on the job to ensure, to the extent possible, equal amounts of job exposure for the CAT IV and Non-CAT IV samples.

The limits in total time on the job within which we were able to match are shown in Table 2. Although relatively few in number, our sample included men in each MOS with up to 20 years of total job experience.

Table 2
Matching Limits

<u>TIME IN JOB</u>	<u>LIMITS</u>
1 - 6 months	± 1 month
7 - 12 months	± 2 months
1 - 6 years	± 3 months
7 - 10 years	± 9 months
11 - 15 years	± 34 months
above 16 years	± 38 months

Since our major purpose was to obtain estimates of current performance in selected jobs, men were chosen as test subjects only after a rather careful check of their actual job duties at the companies to which they were assigned. We eliminated men who were listed on Divisional records as holding or working in an MOS but who, in fact, were not actually working in the specific jobs of interest. For example, Armor Crewmen who held administrative jobs in Armor units, Supply Specialists who were performing as company armorers, and Repairmen who were working as parts clerks, were not included.

We obtained information about background, personal characteristics, and Army history from each man's permanent record. The test administrators were NCOs who had been assigned to us for test development. These individuals formed the nucleus of our test administration teams and were supplemented by men in the appropriate MOSs at each of the locations where testing occurred. All test personnel were specially trained to insure standardization of administration and scoring.

All men were present for two days of testing. On the first day each one filled out a questionnaire in which he described his typical daily job duties; then he took a written test of job knowledge, and the job sample test. Depending on the MOS involved, the job sample test took from three to five hours to complete. On the second day, all men took a battery of questionnaires and tests designed to obtain additional information for cataloguing personal characteristics for later use in describing effective and ineffective individuals.

I would like to describe some of these instruments, although data from only a few will be reported in this paper. Included were biographical questionnaires and checklists; a nonverbal measure of intelligence; tests of carefulness and the ability to comprehend and follow oral directions; tests of memory and digit span; a group form of the Porteus Maze test developed by the Naval Personnel Research Field Activity; and tests of reading, arithmetic, and listening comprehension.

Finally, we administered two questionnaires to the immediate supervisor of each man tested. In one, the supervisor provided ratings of the incumbent's job performance and overall acceptability. In the other, he gave his description of the man's typical daily duties.

Nearly all data reported herein deal with the results of the performance testing; there is a small amount of information from the comprehension tests and the supervisor rating scales. The remainder of the data are being processed by the computer.

The data were collected in the 1st and 2nd Armored Divisions, Fort Hood, Texas; in the 5th Infantry Division at Fort Carson, Colorado; in 4th Armored Division in Europe; and at Fort Ord, California (Table 3).

The minimum *N* for each of these MOSs was set at 360 subjects, or a total of 180 matched pairs. Pairs, as stated earlier, consisted of a IV and a Non-IV matched for time on the job. Between 60% and 70% of the Non-IV sample in each MOS came from Category III. In our comparisons of IVs and Non-IVs, it should be kept in mind that the Non-IV sample is heavily weighted with men from Category III.

Table 3
Location and Number of Matched Pairs

	Armor Crewman (11E)	General Vehicle Repairman (63C)	Unit & Organizational Supply Specialist (76Y)	Cook (94B)
1st ARMORED DIVISION	14	32	28	33
2nd ARMORED DIVISION	31	54	45	50
5th INFANTRY DIVISION(M)	26	112	57	
4th ARMORED DIVISION	121		75	
FORT ORD				107
TOTAL	192	198	205	190

I would like to turn to a description of each of the job sample tests and the results. The General Vehicle Repairman's job will be described first, and since our findings in all MOSs are almost identical, Repairmen will be covered in the greatest detail.

In the General Vehicle Repairman's Job Sample Test, men were presented with a variety of maintenance problems requiring them to perform checks, make adjustments, diagnose and correct malfunctions, and replace parts. Items in the test were selected primarily on the basis of a job analysis conducted in an earlier HumRRO study of organizational maintenance in Armored Units. In that study,¹ Senior Track and Wheel Vehicle Mechanics, Maintenance Sergeants, and Maintenance Officers identified the frequency and urgency associated with performing different tasks on Army vehicles and vehicle subsystems.

The criteria used in selecting maintenance problems for the test included:

- (1) Problems ranging from low to high in the *frequency* with which they occur on the job.
- (2) Problems ranging from low to high in the *urgency* of the required correction.
- (3) Major *vehicle subsystems* including the transmission, electrical, brake, engine, final drive, and fuel systems.
- (4) Problems requiring the use of either or both *diagnostic and adjusting skills*.
- (5) Problems including both the use of *special tools* such as torque wrenches and the use of *test equipment* frequently employed on the job, such as the low-voltage circuit tester.

The 13 subtests of the Repairman's Test are shown in Table 4. As indicated, three different vehicles were used for the test since the

¹John P. Smith, *The Performance of Organizational Maintenance by Track Vehicle Mechanics and Maintenance Sergeants*, HumRRO Technical Report 87, March 1964 (For Official Use Only).

Table 4
Repairman's Test

<u>SUBTEST</u>	<u>NUMBER OF STEPS</u>
SHIFT LINKAGE ADJUSTMENT, M60A1 TANK	11
TRANSMISSION SERVO BAND ADJUSTMENT, M60A1 TANK	13
VOLTAGE REGULATOR ADJUSTING RHEOSTAT ADJUSTMENT, M60A1 TANK	17
HYDRAULIC BRAKE PEDAL ADJUSTMENT, M60A1 TANK	11
OIL SEAL MALFUNCTION IN COOLING FAN VERTICAL DRIVE SHAFT, DETECTION AND REPLACEMENT, M60A1 TANK	19
IGNITION MALFUNCTION, FAULTY SPARK PLUG, DETECTION, M151 JEEP	9
IGNITION TIMING, CHECK AND ADJUSTMENT, M151 JEEP	19
CYLINDER COMPRESSION CHECK, M151 JEEP	13
BATTERY HYDROMETER TEST, M151 JEEP	11
BATTERY CONDITION TEST, M151 JEEP	13
WHEELBEARING, MALFUNCTION, DETECTION AND ADJUSTMENT, M151 JEEP	13
FUEL PUMP PRESSURE CHECK, M35A1/A2, M49C TRUCK	10
BLEEDING SERVICE BRAKE SYSTEM, M35A1/A2, M49C TRUCK	17
	<hr/> 176

General Vehicle Repairman is expected to deal with both wheel and track vehicles.

As an example of how our selection criteria were applied, consider the diagnosis and correction of a leaking oil seal in the cooling fan shaft of an M60A1 tank. This is a medium-frequency problem that requires immediate repair since if all of the oil is blown out, the engine could easily be ruined. The tank has been prepared so that both vertical shaft oil seals are leaking. The man is told that the tank crew has reported oil being thrown out of the fan shrouds and grill doors. He must locate the source of the oil leak and repair the malfunction. Figure 1 shows a man unbolting the fan assembly from the fan tower near the beginning of the problem. In Figure 2 the man is shown after he has worked down to the fan shaft and oil seal housing.

Subjects are given 20 minutes to complete each subtest with the exception of the Leaking Oil Seal problem (30 minutes). Men earn a point for the correct performance of each step in a subtest. This is the standard scoring procedure we used in all MOSs. Where it was

**General Vehicle Repairman's Test--
Unbolting Fan Assembly**



Figure 1

**General Vehicle Repairman's Test--
Inspection of Oil Seal Housing**



Figure 2

essential, in order for a man to continue a test, prompts were given. From this record of prompts, additional measures of a man's ability to start, finish, and work independently were obtained.

The results for the Categories IV and Non-IV groups on the entire job sample test are shown in Figure 3. The graph shows the percentage

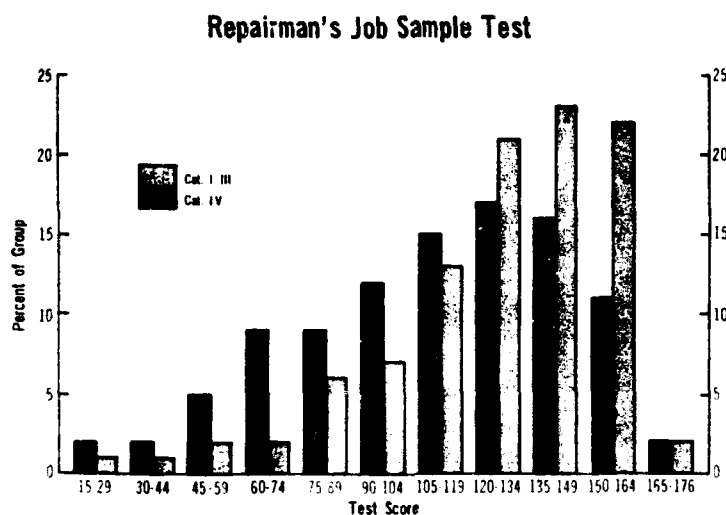


Figure 3

of men in each score interval for the IVs and the Non-IVs. In the total sample of 396 subjects, roughly half fall above 127 points. Using this crude median, 39% of the IVs are in the upper half of the distribution, whereas 61% of the Non-IVs fall in the upper half. While there is obviously considerable overlap in the distributions, with some IVs and Non-IVs appearing at both the top and at the bottom, overall the Non-IVs clearly do better than the IVs. The overlap is not unexpected considering that the Non-IV group contains a heavy weighting of men in Category III.

As mentioned, there are 13 subtests that make up the Repairman's Job Sample Test. When we consider the subtests individually, the superior performance of the Non-IVs appears consistently. The percent of each group falling above the total sample crude median on each subtest is shown in Figure 4. When the battery hydrometer test—one of the easier tests where there is only a slight difference—is included, the Non-IVs invariably outperform the IVs. This occurs in all 13 tests.

As was mentioned, we recorded information each time a man needed a prompt. He was scored as failing to start if he needed more than two prompts at the beginning of a problem. He was scored as "failing to complete" if he needed three successive prompts after starting a problem, if he accumulated a total of four prompts, or if he ran out of time.

Repairman's Job Sample Subtests

Percent of Cat. I-III and Cat. IV Above Median

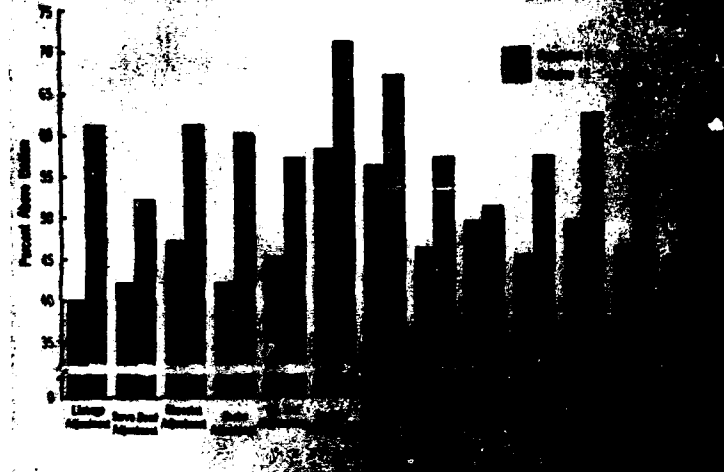


Figure 4

The average percent of IVs and Non-IVs on these measures for all subtests is shown in Table 5, as well as the average percent in each group who completed problems without requiring any prompts. Beyond these averages, an extremely consistent picture appears. On each of the 13 subtests, more IVs were unable to start a problem, more IVs started a problem and then failed to complete it, and finally, more

Table 5
Repairman

Average Percents Not Starting, Not Completing, and Completing Without Prompts (All Subtests)

	Categories	
	IV	I-III
NOT STARTING	16	10
STARTING, NOT COMPLETING	15	9
Total Failure	31	19
COMPLETING WITHOUT PROMPTS	30	40

Table 6
Repairman

Two Selected Subtests - Percent Failure

	Categories	
	IV	I-III
IGNITION TIMING ADJUSTMENT		
FAILED TO START	8	5
FAILED TO COMPLETE	8	4
Total	16	9
BATTERY CONDITION TEST		
FAILED TO START	8	4
FAILED TO COMPLETE	11	4
Total	19	8

IVs needed assistance in order to complete problems.

To allow a comparison of the performance of IVs and Non-IVs in a more absolute manner, we will mention two particular subtests—the ignition timing adjustment and the battery condition tests. They are the two easiest tests in the battery—the combined groups scored higher on these than on any others. Also, they involve very common maintenance problems that any repairman would be expected to deal with.

Table 6 shows the percentage of men who either failed to start these

problems after being prompted or who failed to complete them despite prompts. There are approximately twice as many failures among the IVs.

Another of the criterion measures being reported in this paper is the Supervisor Rating. It consists of two parts; first, a series of items dealing with a man's general acceptance by his supervisor; second, the Enlisted Efficiency Report, which we adopted in its entirety. On both parts of the instrument, Non-IVs on the average received higher ratings than IVs. As is usually the case with ratings, most were clustered at the favorable end of the scale. On the 11 items of Part I, the IVs obtained a mean of 8.7 and the Non-IVs a mean of 9.4. On the Enlisted Efficiency Report, out of a total of 88 points, the IVs obtained a mean of 59 and the Non-IVs a mean of 64. The ratings, then, are consistent with the rest of our data.

Figure 5 shows how job sample test scores varied according to amount of time spent on the job. What seems apparent is the rather

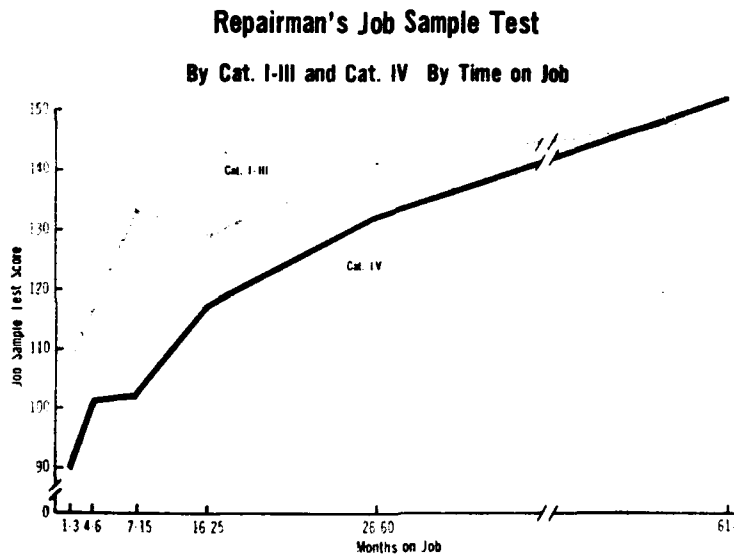


Figure 5

consistent superiority of Non-IVs. For both groups, based on average scores, there is fairly rapid initial growth with some evidence of a tapering off somewhere after two years on the job. At the end point, both groups are achieving approximately 85% of the total test score.

Our first concern in analyzing the data has been with overall trends. It seems wise at this time not to focus on point-to-point comparisons such as one that appears to be a crossing of the curves at the upper end. This may simply be due to a random fluctuation.

In anticipating our data in the other MOSs, note that the IVs do not seem to reach the beginning performance of Non-IVs until sometime after their first year on the job. As will be discussed later, the

same observation can be made for IVs who are Armor Crewmen, Supplymen, and Cooks.

Included among our criterion measures is a conventional multiple choice job knowledge test in which performance is plotted over time (Figure 6). As in the job sample test, performance increases with time on the job and the Non-IVs are superior to the IVs.

Repairman's Job Knowledge Test



Figure 6

We obtained some information about reading skills for the men tested. Remedial education and general education development programs have frequently been used in efforts to upgrade the general effectiveness of men in lower mental categories. In order to gain some notion of how literacy skills are related to actual job performance, we administered tests of reading, arithmetic, and listening ability in conjunction with Work Unit REALISTIC¹ as part of our test battery. Results from only the reading test are available to date. Figure 7 shows the distribution for reading grade level. The relationship between mental category and reading grade is clear.

Figure 8 shows the relationship between scores on the reading test and performance on the job sample test over time. Here, reading grade level is used to further differentiate AFQT groups. Noted in this comparison are:

- (1) There is no curve for IVs at reading grade level 11.0 to 14.5 since no IVs scored above 10.9 on the reading test.

¹HumRRO Work Unit REALISTIC—Determination of Reading, Listening, and Arithmetic Skills Required for Major Military Occupational Specialties.

Repairman's Reading Grade Placement

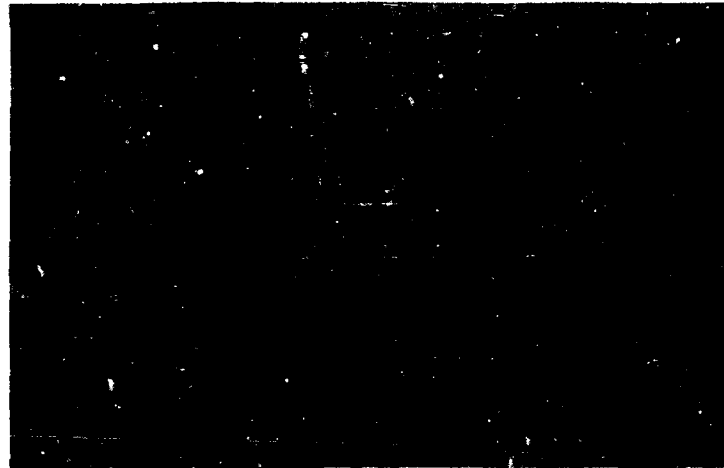


Figure 7

Repairman's Job Sample Test By Cat. I-III and Cat. IV By Reading Grade Levels By Time on Job

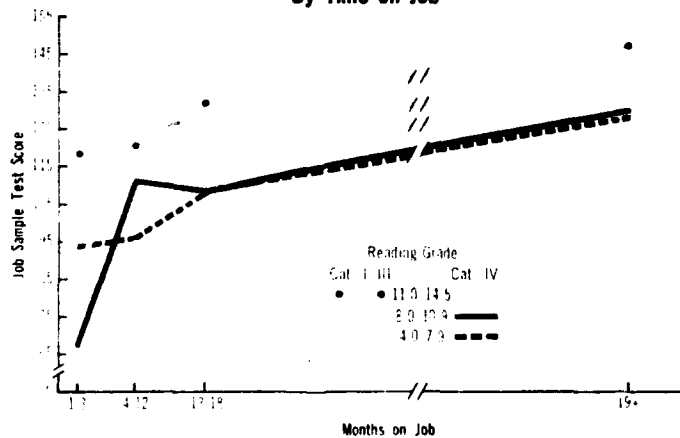


Figure 8

(2) In the Non-IVs, who score above IVs at all but one point, there is evidence of a relationship between reading ability and performance.

(3) Finally, in the IVs we find no relationship between reading ability and performance.

We want to conduct some further analyses before drawing more conclusions. We know that AFQT scores are highly related to reading and want to further partial out their effects, as well as to introduce some additional intervals for time on the job.

We do know, however, that IVs are able to use written material in the job situation despite their generally lower level of reading ability. In separate analyses, we found that men who used manuals in the test situation performed better than men who did not. This was true for both IVs and Non-IVs. Further, the IVs who used manuals benefited more than the Non-IVs who used manuals. Doubtless this was partly due to their having more room for improvement. Nevertheless, the point remains that IVs were able to use manuals to their advantage.

Figure 9 gives some information about the effects of school training, showing results on the job sample test for IV and Non-IV groups

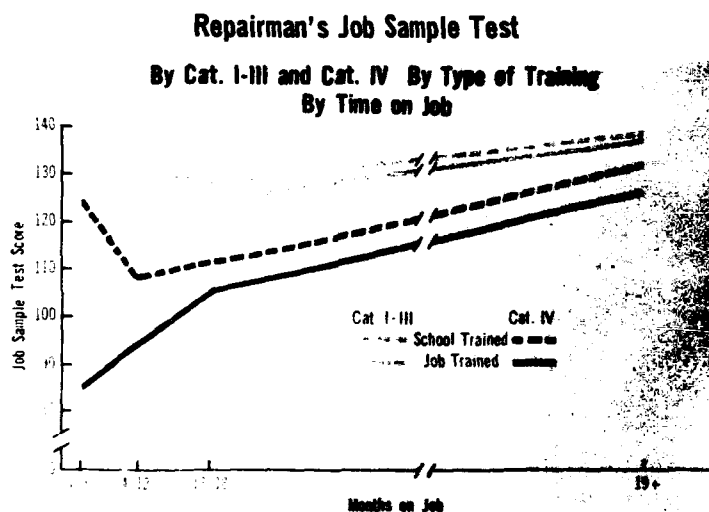


Figure 9

separated into those who received on-the-job training and those with formal school training. With the exception of men with the least amount of job experience, the relationships are clear:

- (1) School-trained IVs do better than job-trained IVs.
- (2) School-trained Non-IVs do better than job-trained Non-IVs.
- (3) Non-IVs, whether school-trained or job-trained, do better than IVs.

There is essentially the same relationship shown in the results for the job knowledge test (Figure 10). In some preliminary analyses in the other MOSs, we have not found the clear superiority of school training over job training that is apparent in this test. Until further analyses have been done in the other MOSs, we cannot make a general statement about the role of school training as it affects the performance of IVs and Non-IVs.

Repairman's Job Knowledge Test

By Cat. I-III and Cat. IV By Type of Training
By Time on Job

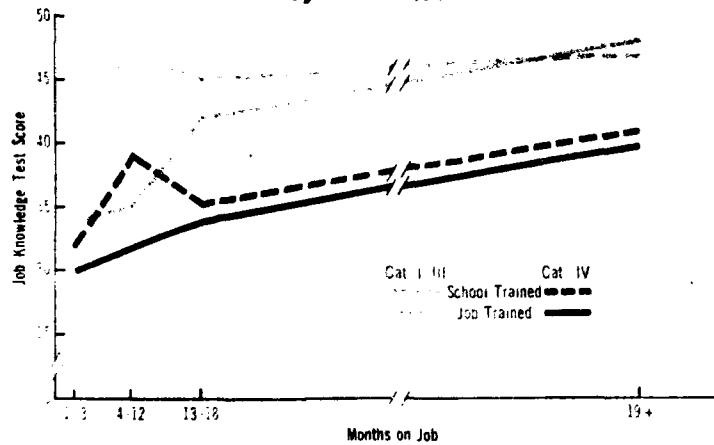


Figure 10

I would like to describe the job sample tests and some of the data for Armor Crewmen, Supplymen, and Cooks, showing the distribution of job sample test scores and graphs of job sample and job knowledge test scores by time on the job.

In the case of the Armor Crewman, the test is largely an extension and updating of the Armor Mastery Test Battery built earlier by HumRRO in conjunction with the Armor School at Ft. Knox, Kentucky. This battery was originally designed to assess the mastery of a man's performance after Advanced Individual Training in the gunner, loader, and driver positions of the M48 Tank.¹ Our revision of these tests involved updating them for the M60A1 tank and incorporating a few additional requirements that would have been inappropriate for a man without experience beyond AIT. Also, except for a few essentials, we virtually eliminated a tank driving test from the original battery because of the cost of building special driving courses at each testing installation. The 20 subtests of the Armor Crewman Test are shown in Table 7.

No time limits were imposed in this test. Scoring procedures were the same as those used in the Repairman's Test. Since our test was derived from a mastery test, all of the tasks and knowledges involved are considered essential—the titles are, in general, self-explanatory. Although we eliminated most of the driving subtest, we kept all of the driver-related activities. Also, some of the basic skills in driving are represented in the subtest "Driving in Response to Arm and Hand Signals," in which the men drove the tank forward, backward, and made

¹HumRRO Work Unit SHOCKACTION—Evaluation and Improvement of Individual Training for Tank Crewmen.

Table 7
Armor Crewman's Test

<u>SUBTEST</u>	<u>NUMBER OF STEPS</u>
BEFORE OPERATIONS MAINTENANCE	15
DEMONSTRATION OF ARM & HAND, FLAG & LIGHT SIGNALS	24
IDENTIFYING AND NAMING FUNCTIONS OF THE DRIVER'S CONTROLS	16
STARTING & STOPPING THE MAIN ENGINE, HOT & COLD WEATHER PROCEDURES	19
DRIVING IN RESPONSE TO ARM & HAND SIGNALS	9
ARRANGEMENT OF MINIATURE TANKS INTO COMBAT FORMATIONS	16
DISASSEMBLY, ASSEMBLY, IDENTIFICATION OF PARTS OF:	
Cal. .45 Pistol	28
Cal. .45 Submachine Gun	30
Cal. .50 Machine Gun	45
Coaxial Machine Gun	23
MOUNTING & OPERATING:	
AN/VRC 53 Tank Radio	9
AN/VRC 12 Tank Radio	14
READING & SETTING:	
Ballistic Computer	22
Azimuth Indicator	6
PUTTING TURRET INTO POWER, CHECKING AZIMUTH INDICATOR FOR ACCURACY AND SLIPPAGE	20
PERFORMING THE END FOR END TEST ON THE GUNNER'S QUADRANT, ZEROING THE ELEVATION QUADRANT	15
PREPARATION OF RANGE CARD	15
BORESIGHTING & ZEROING THE 105MM GUN	17
LOADING THE 105MM GUN	7
ADJUSTMENT OF FIRE IN RESPONSE TO COMMANDS	9
	<hr/> 359

some turns. Figure 11 shows a test administrator guiding a driver in a left turn.

Figure 12 shows the distributions of job sample test scores for the Armor Crewman. As in the case of the Repairman, the Non-IVs do better than the IVs, although there is considerable overlap in the distributions. Forty-three % of the IVs fall above the crude median of 251,

**Part of Subtest "Driving in Response
to Arm and Hand Signals"**



Figure 11

Armor Crewman's Job Sample Test

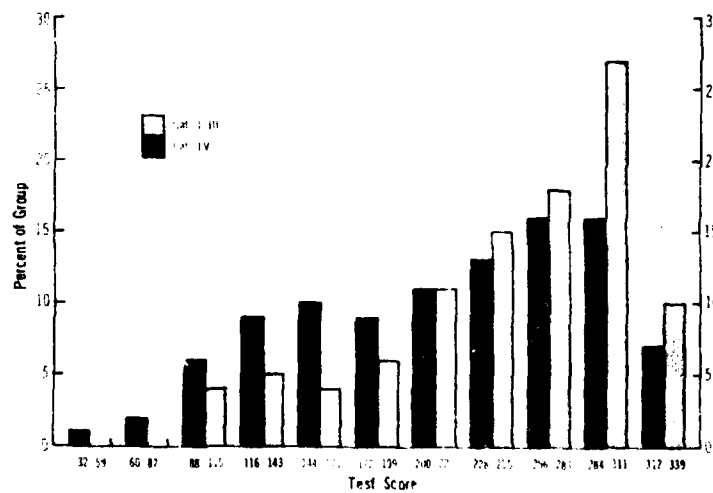


Figure 12

whereas 57% of the Non-IVs fall above this point. In the subtests, Non-IVs again consistently did better than IVs. The problems show, individually, that Non-IVs outperformed IVs 20 out of 20 times.

Figure 13 shows how job sample test scores varied according to time on the job. The Non-IVs again remained superior over time, although

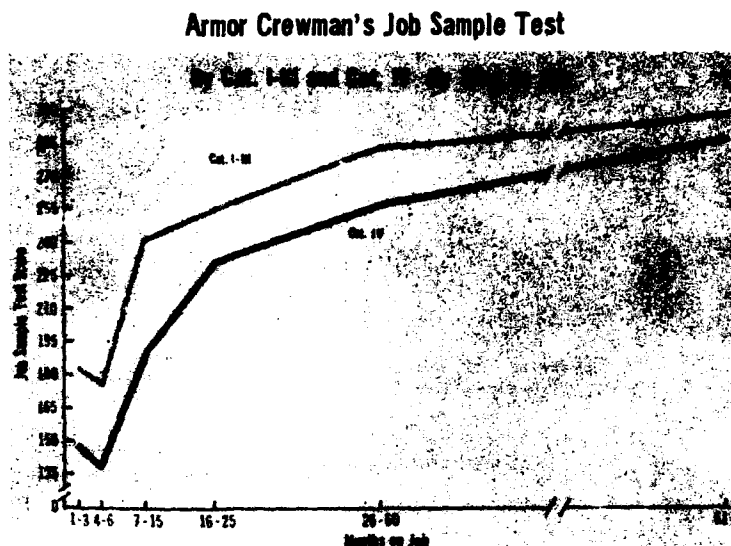


Figure 13

one would suppose that the curves come together at some point beyond five years. As with the repairmen, the IVs do not reach the beginning performance of Non-IVs until after at least a year on the job.

Note the decrement in both groups at 4 to 6 months. In all of our MOSs, we find either this dip or a decrease in rate of growth at 4 to 6 months or shortly thereafter. While the consistency of this change suggests it may be a real phenomenon, we have not, as yet, been able to find a satisfactory explanation. One class of explanation might involve changes within the man, such as some form of forgetting and relearning, or perhaps changes in motivation. Another possibility is that somehow the sample itself changes between the first and second three-month periods on the job. For example, perhaps within the first three months some men may be seen as more able and may be chosen for reassignment. We have not been able, as yet, to study the characteristics of the individuals who appear at these two points in time. Since our data were collected at different times of the year and in different units at different installations, it seems unlikely that systematic changes in input or factors peculiar to location are responsible.

Figure 14 shows how the job knowledge scores varied over time, illustrating again the superiority of the Non-IVs and the decrement at 4 to 6 months.

Armor Crewman's Job Knowledge Test

By Cat. I-III and Cat. IV By Time on Job

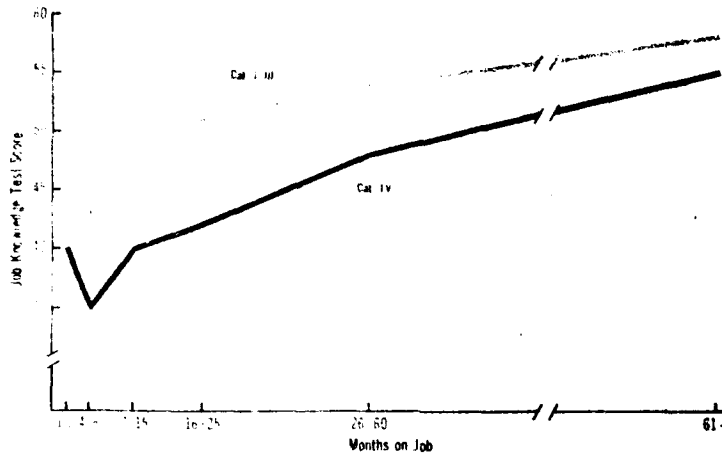


Figure 14

Next let us consider the Unit and Organizational Supply job. The supply specialist's job can vary from being quite specialized to fairly general. As a supply clerk, he may merely transcribe information from one form to another. As a supply sergeant, he will audit material on hand, determining proper allowances by searching in a Table of Organization and Equipment, and finding the procedure in an Army Regulation for disposing of material. The heart of his job, however, lies in the clerical tasks he performs in requesting, turning-in, and accounting for supplies. This was one of the reasons we chose the Supply MOS to represent clerical jobs in general, focusing on clerical aspects to construct the job sample test.

After examining the clerical duties of the supplyman in detail, and consulting with the HumRRO staff at Division No. 1, who were conducting a job analysis¹ for a revision of the Basic Supply Course at the Quartermaster School, we used the following criteria in selecting problems for the test:

- (1) Problems ranged from low to high in the *frequency* of occurrence on the job.
- (2) Problems ranged from simple to complex in *difficulty*.
- (3) Problems involved *standard procedures* rather than procedures likely to be influenced by local SOP.
- (4) Job requirements of clerks in general were covered, such as:
 - (a) Following instructions.
 - (b) Being familiar with job materials—in this case, with forms and reference publications.

¹HumRRO Work Unit STOCK—Development of Training Management Procedures for Heterogeneous Ability Groups.

- (c) Being accurate in recording information, in searching for information, and in carrying out simple computations.
- (d) Reconciling items of information, recognizing discrepancies, and making corrections or adjustments.

In order to provide background information and a setting in which to administer the test problems, we fabricated a company and company supply room, as shown in Figure 15.

Company Supply Room Constructed for Test



Figure 15

The supply room contained a set of supply publications, a collection of blank forms similar to those that would be on file were the subject to arrive at our hypothetical company as a newly assigned supply sergeant, and also a set of Property Books for the company. We did not include all of the other equipment and supplies that might be found in a typical supply room, only those features essential to the test.

Table 8 lists the eight test problems. All subtests but one required the preparation of a form as part of a particular supply action. In presenting each problem, the subject was given instructions in a manner that required him to begin by identifying the appropriate form. For example, in the problem involving the Personal Clothing Request, the subject was told that a new man had returned from Vietnam bringing with him a form listing the clothing he had in his possession. The subject's instructions were to make out the proper form so the new man could receive the remainder of his authorized clothing allowance from the Clothing Sales Store. No time limits were placed on any subtests.

Table 8
Supply Test

<u>SUBTEST</u>	<u>NUMBER OF STEPS</u>
PREPARATION OF PERSONAL CLOTHING REQUEST.....	15
PREPARATION OF STATEMENT OF CHARGES.....	33
MAINTENANCE OF DOCUMENT REGISTER.....	15
PREPARATION OF LAUNDRY ROSTER.....	25
PREPARATION OF HAND RECEIPTS.....	12
PREPARATION OF MAINTENANCE REQUEST.....	27
PREPARATION OF REQUEST FOR ISSUE.....	19
SORTING EQUIPMENT FOR SERVICEABILITY.....	10
	<hr/> 156

The distributions of job sample test scores for supplymen are shown in Figure 16. Again the superiority of Non-IVs is shown, but with overlapping distributions. Thirty-eight % of the IVs fall above the median of 94, whereas 62% of the Non-IVs are above the median. In the eight subtests, again the Non-IVs, without exception, did better.

Supplyman's Job Sample Test

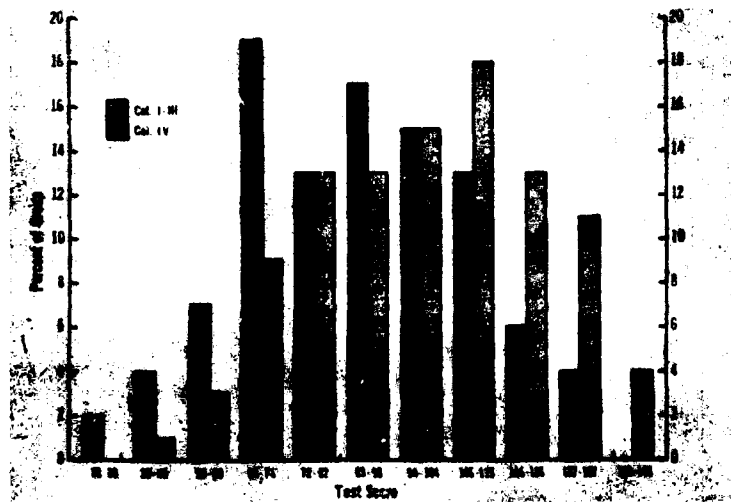


Figure 16

Figure 17 shows the job sample scores by time on the job. Again, as in the other MOSs, there is clear superiority of the Non-IVs. Also, the "dip," as in the Armor Crewman performance, is apparent. Figure 18 gives the job knowledge scores by time and illustrates a similar trend.

Supplyman's Job Sample Test

By Cat. I-III and Cat. IV By Time on Job

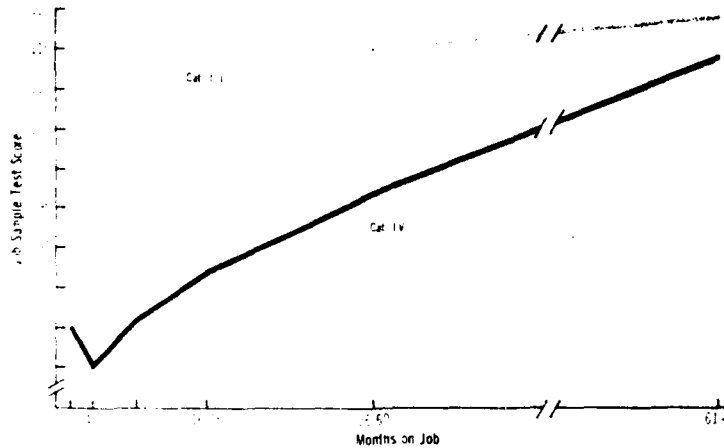


Figure 17

Supplyman's Job Knowledge Test

By Cat. I-III and Cat. IV By Time on Job

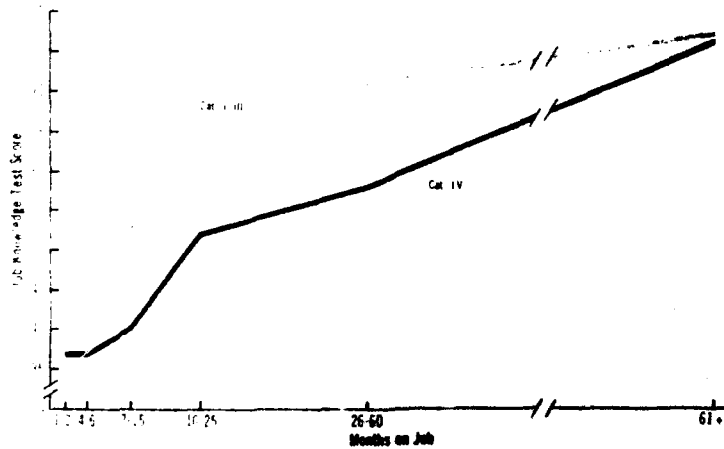


Figure 18

Next, let us consider the Cook's Job Sample Test and the men's performance on it. In selecting items for the test, we referred to the cook's duties as identified in a job analysis carried out some time ago by an Air Force Research group. This analysis was partially repeated later by HUMRRO. Both studies showed that the number and variety of tasks performed by cooks is quite extensive. For example, in addition to the many different activities directly associated with

the preparation of food, a cook's job can range from performing simple maintenance on a wide variety of powered and heating equipment to conducting inventories and to procuring and storing foods.

It became clear in selecting problems for the test that sampling across such a broad range of tasks would not be possible. Time represented a major constraint in the number of tasks that could be included.

Another factor was the sizable logistic problem of setting up individually administered performance tests. There were limits on the number of isolated test stations that we could arrange since each required work space, a stove, utensils, and so forth. We found a partial solution by using field equipment for the administration of the test.

In order to restrict the range of tasks to be covered, we focused primarily on cooking, where most of the more distinctive demands of the job exist. To assess a man's cooking ability, problems were designed to tap the properties of a cook's job that we identified as characteristic. These are:

- (1) The *ability to follow directions* accurately. When cooking tasks are examined, many are found to be relatively simple and procedural. Often the steps have been clearly specified in a cook book.
- (2) The *ability to modify or adjust proportions* of ingredients to meet the requirements of special situations and to be able to perform any arithmetic calculations that may be necessary in making these adjustments.
- (3) Being accurate or *precise in the measurement* of ingredients.
- (4) Being able to maintain *constant attention* to ongoing events, particularly when two or more food items are being prepared simultaneously.
- (5) Being able to *plan ahead*. Frequently advance or partial preparation is required for steps that will come later in a recipe. These needs must be anticipated and the sequence of steps outlined in the recipe reorganized to accommodate to such requirements.
- (6) Being *resourceful* or exercising ingenuity in dealing with situations where using a standard procedure may not be possible.

The five subtest problems of the Cook's Test are shown in Table 9.

Table 9
Cook's Test

SUBTEST	NUMBER OF STEPS
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COCOA.....	38
SCRAMBLED EGGS.....	10
PREPARATION OF COOK'S WORKSHEET.....	36
JELLYROLL.....	45
LIGHTING FIRE UNIT.....	29
	158

We devised the tests to measure some of the special characteristics of the job, as is shown in the following description of the jellyroll subtest:

Preparing a jellyroll is the longest and most complicated cooking task facing a subject, although the standard steps to be followed are given in a recipe book. The subject is scored, as in the other cooking tests, for using both the correct ingredients and the correct amount of each ingredient. For example, he has both hard and soft wheat flour available. The recipe specifies that soft wheat flour is to be used and the subject must do so to receive credit. Another step in the procedure requires warming an egg-sugar mixture over hot water. The need for jerry-rigging a hot water bath must be anticipated and the water heated beforehand. Figure 19 shows a subject beating eggs as an early step in the preparation of the jellyroll.

Part of Jellyroll Subtest of Cook's Test



Figure 19

Figure 20 shows the distributions of the job sample test scores. Thirty-five % of the IVs are above a median of 92, whereas 64% of the Non-IVs are there. On all five subtests the Non-IVs did better, as they did on the job sample scores by time (Figure 21) and on the job knowledge scores by time (Figure 22).

Summarizing across all MOSs, our major findings thus far are as follows:

(1) With up to five years of job experience, men in Mental Categories I-III perform better than men in Mental Category IV, as measured by job sample tests and job knowledge tests.

Cook's Job Sample Test

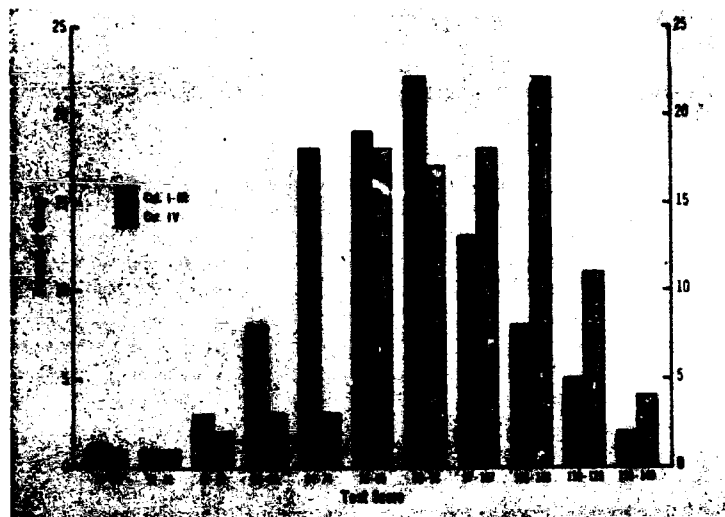


Figure 20

Cook's Job Sample Test

By Cat. I-III and Cat. IV By Time on Job

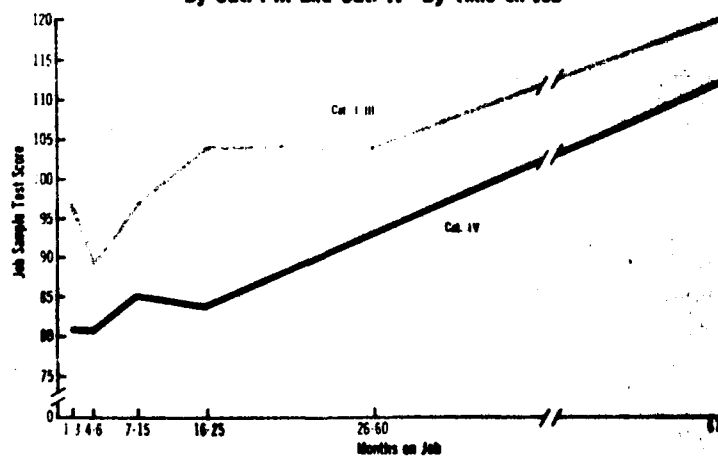


Figure 21

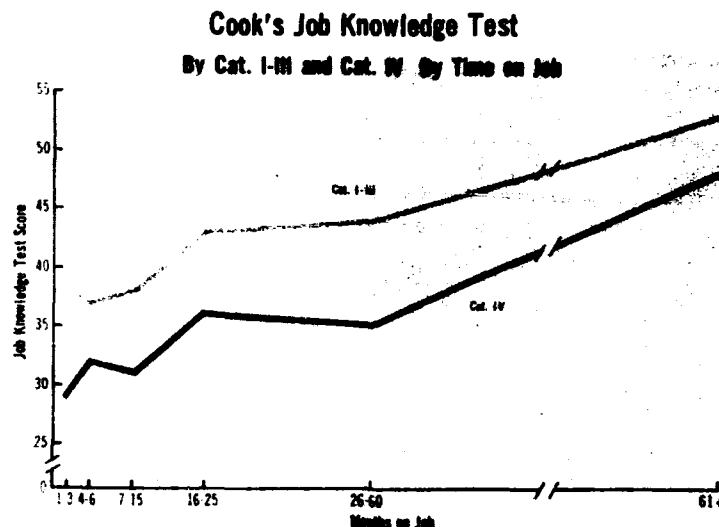


Figure 22

(2) At each level of job experience, there are men in Mental Category IV who do well; conversely, there are men in Mental Categories I-III who do poorly.

(3) In general, men in Mental Category IV require at least a year of job exposure before they perform at the level of men in Mental Categories I-III who are new in the job.

In the future, we expect to be doing analyses similar to those described here. For example, we plan to analyze the job duties of IVs and Non-IVs. This analysis will be based partly on the statements of daily job duties provided by each subject and his supervisor, and partly on information obtained during each job sample problem, about the subject's amount of previous experience with the problem. It is possible that IVs, in general, tend to engage in somewhat different job activities from Non-IVs. If so, we plan to provide the Army with this information, as well as relate it to our own findings.

Next, we want to provide a more general description of the capabilities of the IVs and Non-IVs—a description not tied to the performance of a particular job. To do this, we have devised a system of categorizing each step to be performed in the job sample problems in terms of its amount of structure and the degree of knowledge that each subject must provide. This classification system should permit a more general judgment about the kinds of things that IVs can and cannot do, or about the kinds of activities that distinguish effective and ineffective performers, regardless of AFQT scores.

Finally, and most importantly, we need to identify the background characteristics of effective and ineffective men. Since there are IVs who do well and Non-IVs who do poorly at every level of job experience, it seems questionable to categorically exclude men from the services

solely on the basis of AFQT scores. For example, if Old Standards men, those with AFQT scores between 21 and 30, were not taken into the service, 48%, or roughly half of them who scored above the overall median on the job sample test would be excluded. If New Standards men, those with AFQT scores between 10 and 20, were not taken into the service, 29% of them who scored above the overall median would be excluded. Clearly, either procedure would be excluding from the military service a fair proportion of the men who do well.

Using a method of cluster analysis, we will analyze background information and paper-and-pencil test scores as they relate to performance. Ultimately, we hope to sort out effective men on the basis of some combination of personal attributes and background and Army experiences. Outcomes of these analyses relate directly to some of the more obvious implications of our data.

Apart from the differences between IVs and Non-IVs, perhaps the most important observation is that poor performance is not necessarily permanent. In general, IVs reach the level of beginning Non-IVs after approximately a year on the job and performance curves seem to converge after a considerable length of time on the job, giving rise to the question: Can the rate of growth in performance be accelerated? Before trying to answer, we need to examine the source of growth. First, do all men uniformly improve on the job over time, or do only certain men improve, or do the poor performers drop out? Answers wait upon the examination of the characteristics of men that we find at these different points in time. If only certain people improve, selective assignment may be the appropriate strategy for intervention, whereas, if all people improve but at different rates, then procedures that take these individual differences into account are required—perhaps different types of training for different types of people.

Another prior question has to do with the manner of performance improvement. Does performance improve because of growth in all required skills, or is there a pattern of improvement in only certain areas of the job? If improvement in a particular set of skills is the primary source of growth, then efforts to improve performance should probably focus on the development of training materials specifically designed for these skills.

Other research efforts at HumRRO, notably Work Units SPECTRUM¹ and APSTRAT,² are well on the way toward developing training strategies appropriate for particular segments of the AFQT distribution. If UTILITY is successful in identifying potentially successful men, this combination of research offers hope of providing specific guidelines for upgrading the performance of men over the entire AFQT range.

¹HumRRO Work Unit SPECTRUM—Development of Efficient Training for Soldiers of All Aptitude Levels.

²HumRRO Work Unit APSTRAT—Training Strategies and Incentives Appropriate to Different Aptitude Levels for Selected Army Training Courses.

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13. ABSTRACT This paper summarizes and illustrates some of the early findings of HumRRO research to determine how soldiers in Mental Category IV and in other mental categories on the Armed Forces Qualification Test compare in the performance of jobs. Tests are described and results shown with data gathered from five selected MOSs--Armor Crewman, General Vehicle Repairman, Unit and Organizational Supply Specialist, Cook, and Medical Corpsman.		

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Medical Corpsman MOS						
Performance Measures						
Project 100,000						
Unit and Organizational Supply Specialist MOS						

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